Volume 4 Article 8

4-1-1977

Research Notes: Induced floral abnonnality in soybean

B. B. Singh
G. B. Pant University of Agriculture and Technology

A. N. Jha
G. B. Pant University of Agriculture and Technology

G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
Department of Plant Breeding
Pantnagar (Nainital) U.P., India

1) Induced floral abnormality in soybean.

One of the M_3 progenies of Type-49 soybean irradiated with 15 kr gamma rays showed segregation for plants with abnormal flowers. The progeny consisted of 30 normal plants and 8 mutant plants, indicating a monogenic inheritance. The mutant plants set only a few pods and appeared almost sterile at maturity. The M_4 progenies derived from normal plants were again screened for genetic segregation and detailed studies on floral abnormality of mutant plants were made. Of the 28 progenies planted, 18 segregated and 10 bred true for normal plants, giving a close fit to 2:1 ratio. The total number of normal and mutant plants pooled over all segregating progenies were 762 and 245, respectively, which fitted closely to a 3:1 ratio, with no heterogeneity among the progenies. Thus, this character is under monogenic control.

Floral abnormality: The normal and mutant plants appeared identical until the onset of flowering, after which the differences began to set in. Most of the buds of the mutant plants did not open at all and those which did were only partially open. A close examination of these flowers revealed very interesting differences. These flowers had invariably more than 5 sepals, more than 5 petals (including two standard petals), less than 10 stamens and more than 1 pistil, but the total number of floral parts per flower never exceeded 21. In most of the cases, it was 21, with occasional flowers with 18-20 parts. It was observed that the reduction in the number of stamens was always equal to the increased number of sepals, petals and pistils. The extra sepals were always petaloid and these were in inner ring surrounded by 5 true sepals. Some of the petals and pistils had anthers on them. When dissected, these anthers showed normal pollen grains. The pollen grains from normal anthers were also viable and germinated in sucrose solution but the dehiscence was very poor.

These observations indicate that the mutant gene is primarily affecting stamen differentiation. Apparently the regulatory control for the differentiation of stamen primordial cells is less effective in the mutant plants, leaving some of the cells in confused state. Since the immediate neighboring cells are either for petals or pistils, some of these confused stamen primordial cells might be picking up regulatory signals from these and differentiating into petals or pistils. Increased number of petal cells in the inner ring might be causing a push-back reaction to convert some of the outer petal cells into petaloid sepals. As the mutant plants become older, the effect of this gene becomes more generalized and the whole bud develops into an undifferentiated mass.

The gene symbol "ft ft" (flower transformed) has been assigned for this character.

Reference

Meyer, V. G. 1966. Flower abnormalities. Bot. Rev. 32: 165-218.

B. B. Singh
A. N. Jha

2) Isozymic variations in black- and yellow-seeded isogenic lines of 'Bragg' soybean.

Occasional black seeds are noticed in 'Bragg' seed lots obtained from large multiplication plots. The frequency of such seeds varies from 10^{-5} to 10^{-7}, indicating that the black seeds result from spontaneous mutation. The plants grown from black seeds are identical to Bragg plants in every respect so that, without opening the pods on mature plants, it is impossible to distinguish the two types of plants. The mean agronomic performance of black- and yellow-seeded Bragg in replicated trials is given in Table 1. No significant difference was observed for any of the characters. Thus, these lines appear to be isogenic except for difference in seed coat color.

The preliminary data have indicated black seed coat to be a recessive trait and the character is under monogenic control. Apparently, the two lines differ with respect to one gene only. We wanted to check whether this would be reflected in terms of single biochemical difference also. The black and yellow seeds were kept in moist sterilized sand for germination. After 72 hours, the germinating seeds were separated into seed coat, cotyledons, and root-shoot axis. Three grams of each kind of tissue were ground in 3 ml phosphate buffer (pH 7.0). The homogenate was centrifuged and the supernatant was used for disc-electrophoresis. The electrophoresis was performed in Tris-glycine buffer at pH 8.5. After electrophoresis, the gels were stained for protein, and different enzymes.

Table 1

Agronomic characteristics of black- and yellow-seeded isolines of Bragg soybean

Character	Yellow seed	Black seed
Days to flower	45	45
Pubescence color	Tawny	Tawny
Flower color	White	White
Disease	Severe yellow mosaic	Severe yellow mosaic
Days to maturity	113	113
Plant height (cm.)	69.3	68.5
Pods per plant	70.4	64.9
Seeds per pod	2.10	2.21
100-seed weight	14.00 g	14.35 g
Yield kg/ha	1418	1666

No significant differences were noticed in the number of bands and banding patterns for proteins or enzymes between cotyledons and root-shoot axes of black and yellow seeds. However, the seed coats of the two lines differed quite markedly for proteins as well as for peroxidases, esterases, and acid and alkaline phosphatases. The number of bands and banding pattern for these enzymes are presented in Fig. 1. It is apparent from Fig. 1 that the black seed coat is completely devoid of proteins, peroxidases, acid phosphatases and alkaline phosphatases, whereas in the yellow seed coat at least 6 protein bands, 5 peroxidase isozymes, 5 acid phosphatase isozymes and 4 alkaline phosphatase isozymes could be detected. The black seed coat had a fast moving esterase in place of 3 esterase isozymes of yellow seed coat.

These observations indicate that the mutation affecting seed coat color is also checking the synthesis of a number of proteins and enzymes. Since the inheritance of this character is monogenic with a single phenotypic effect, the multidirectional differences at biochemical level indicate that this is probably a complex locus consisting of several closely-linked genes, all being affected simultaneously by a single mutation. Alternatively, this gene might be blocking the synthesis of a substrate (factor) which is common in the synthetic pathways of different proteins and enzymes. Still another possibility is that this gene may have regulatory function in activating several genes.

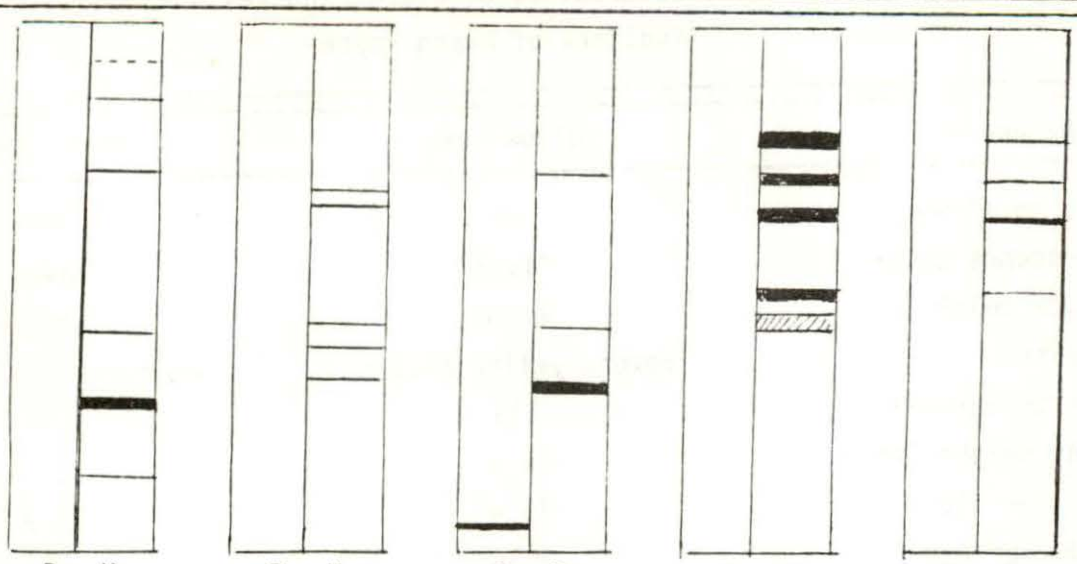

Figure 1. Isozymic variations in the seed coats of black (B) and yellow (Y) seeded isogenic lines of Bragg soybean.

S. S. Malik
B. B. Singh

GERMPLASM RESOURCES LABORATORY
PLANT GENETICS AND GERMPLASM INSTITUTE
Agricultural Research Center-West
Beltsville, MD 20705

1) <u>Procedures for handling soybean germplasm between the United States and foreign countries</u>.

Federal, state, and commercial soybean breeders periodically receive direct requests for seed from potential foreign cooperators, including both those who are technically qualified to undertake research and those who have little experience with the crop and are initiating programs for the first time. The Germplasm Resources Laboratory in Beltsville, MD, also receives numerous requests from foreign cooperators as a result of its involvement in the international germplasm exchange program that has been operating for 25 to 30 years. In addition, U.S. breeders request specific germplasm from